

CPE Online
Accounting for Derivatives Conference
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Fundamental Valuation Concepts - Commodities

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1

Derivative Products

Types of Derivatives

Option Contracts

Forward Contracts

Futures Contracts

Swaps and Swaptions

Options

- **Call** - A contract giving the holder the **right**, but not the obligation, to **buy** a specific asset for a fixed price during a specific period.
- **Put** - A contract giving the holder the **right**, but not the obligation, to **sell** a specific asset for a fixed price during a specific period.

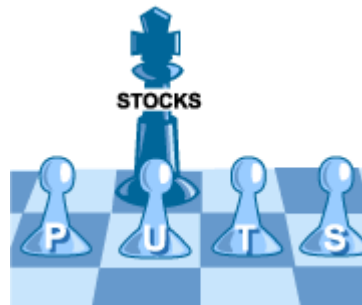
Uses of Options

Purchased puts - used in situations similar to short forwards/futures

Purchased calls - used in situations similar to long forwards/futures

Decision may be based on:

- ✦ Likelihood of hedged transaction occurring
- ✦ Use options to protect downside while retaining upside (like insurance policy)



Uses of Options (Cont'd)

- ✦ One can combine options and other derivatives in a process known as 'financial engineering' to **control the risk** in a given transaction
- ✦ Nonlinear nature of options makes hedging and valuation more complex
- ✦ Generally more sophisticated users

Options

Important Distinctions

- ✦ American/European/Bermudan/Asian
- ✦ Covered vs. Naked
- ✦ Intrinsic Value
- ✦ Embedded/Freestanding Options
- ✦ Exotic Options

Underlying Assets/Derivatives

- ✦ Bonds/Equities/Indices
- ✦ Currencies
- ✦ Futures
- ✦ Swaps

Option Characteristics

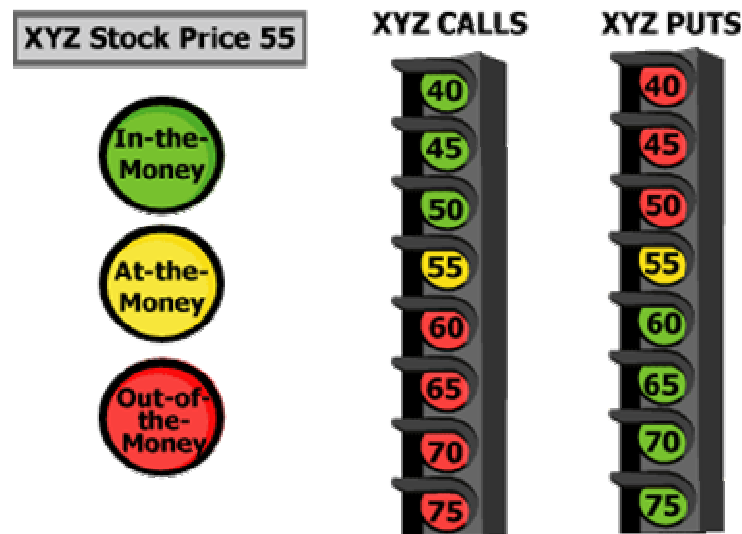
- ✦ Purchaser pays/seller receives a premium up front

$$\begin{array}{ccccc} \text{Premium} & & \text{\# of} & & \text{Total Cost} \\ & & \text{Contracts} & & \\ \boxed{2.5} & \times & \boxed{1} & = & \boxed{\$250.00} \end{array}$$

- ✦ Purchaser enjoys upside potential with downside limited to premium paid
- ✦ Seller bears downside risk with upside limited to the premium received

Options Profit/Loss Terminology

	Call	Put
In-the-Money	X Less than P	X Greater than P
At-the-Money	X = P	X = P
Out-of-the-Money	X Greater than P	X Less than P

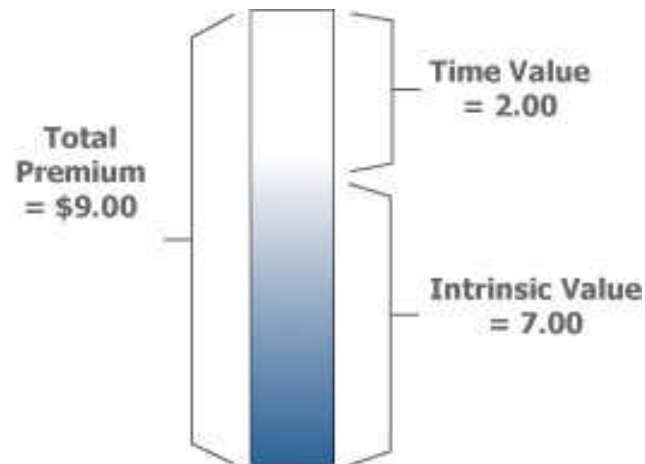


X = exercise (or strike) price

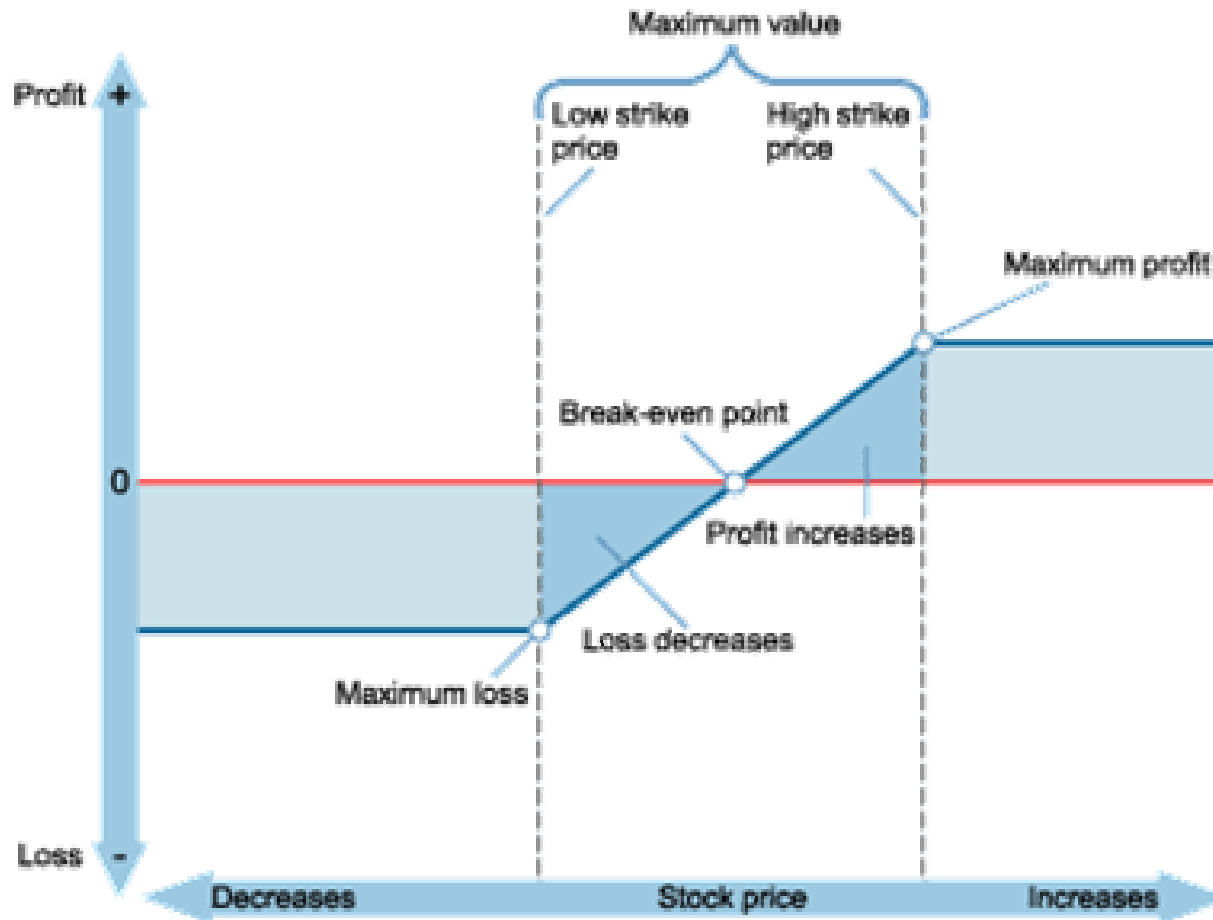
P = current underlying stock price

Option Premium

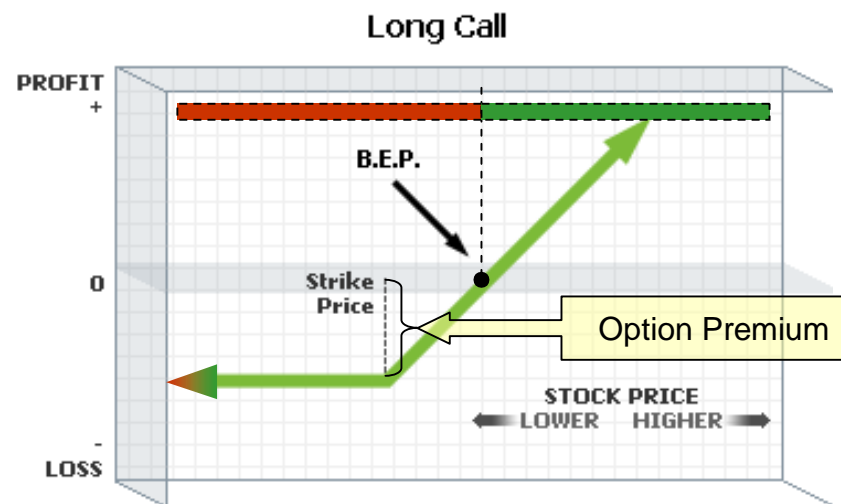
Intrinsic and Time Value	
Option	Premium = Intrinsic Value + Time Value
In-The-Money Options:	Premium = Intrinsic Value + Time Value
At-The-Money Options:	Premium = All Time Value
Out-Of-The-Money Options:	Premium = All Time Value



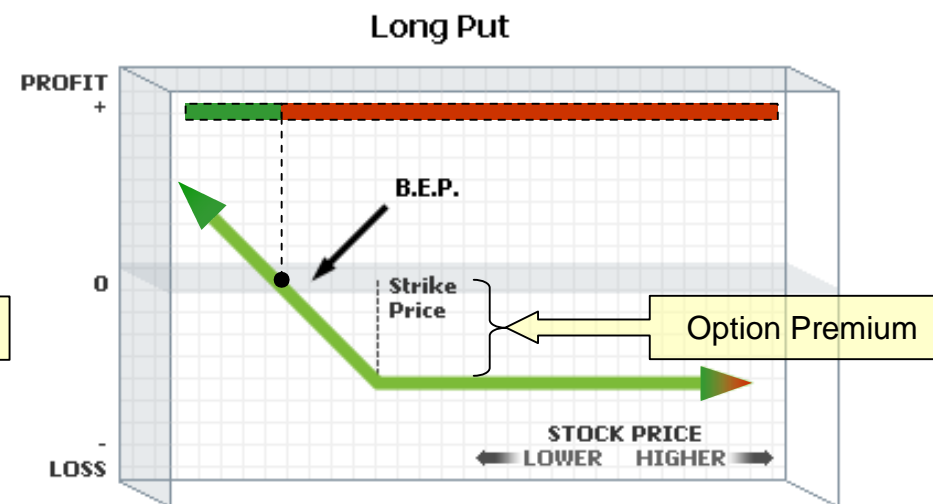
Understanding an expiration profit-loss chart



Long Options



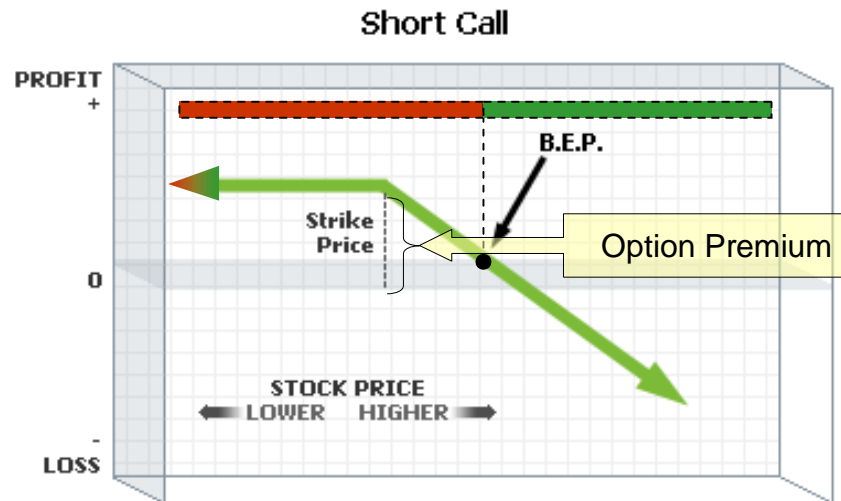
The X-axis represents the price level of an underlying stock. The Y-axis represents profit and loss, above and below the X-axis intersection respectively. B.E.P. is the Break Even Point.



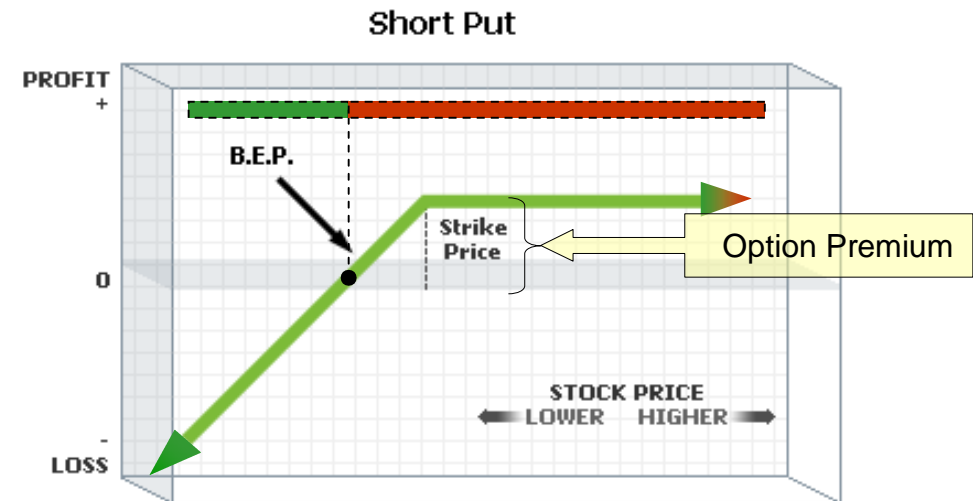
The X-axis represents the price level of an underlying stock. The Y-axis represents profit and loss, above and below the X-axis intersection respectively. B.E.P. is the Break Even Point.

- In-the-money
- Out-of the-money

Short Options



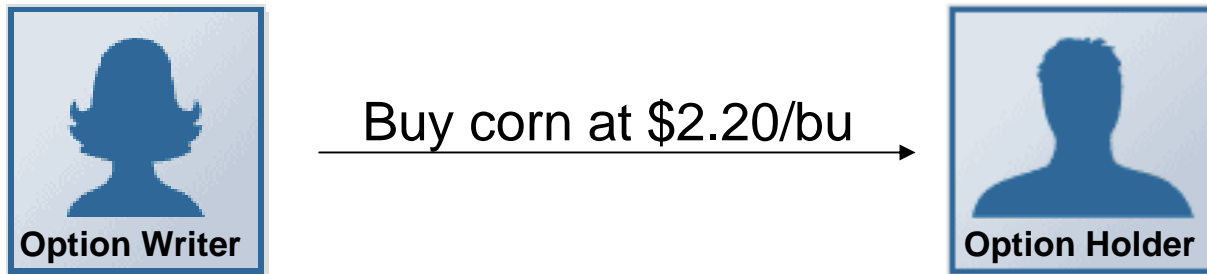
The X-axis represents the price level of an underlying stock. The Y-axis represents profit and loss, above and below the X-axis intersection respectively. B.E.P. is the Break Even Point.



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- In-the-money
- Out-of the-money

Option Contracts



Assume: Market price per bushel is \$2.22
notional amount is 100,000 bushels
option value is \$2,400

Intrinsic Value is the difference between the strike price and the market price ($100,000 \text{ bu} \times (\$2.20 - \$2.22) = \$2,000$)

Time Value is the value of the option less the intrinsic value ($\$2,400 - \$2,000 = \$400$)

Forwards

Definition:

- ✦ A contract to buy or sell a specified amount of an asset at a specified fixed price with delivery at a specified future point in time.
- ✦ Parties to **forward** contract typically **pay nothing** to enter into contract at its inception.
- ✦ Price of forward contract is the price that makes the values of both the long and the short zero at contract initiation.
- ✦ The total change in the value of the forward contract is measured as the difference between the forward rate and the asset's spot rate at the forward date.

Differences Between Forwards and Futures Contracts

	Forwards	Futures
Primary market	Dealers	Organized Exchange
Secondary market	None	The Primary market
Contracts	Negotiated	Standardized
Delivery	Contracts Expire	Rare Delivery
Collateral	None	Initial Margin, Mark-to-Market
Credit risk	Depends on Parties	None [Clearing House]
Market participants	Large Firms	Wide Variety

Uses of Forwards and Futures

Sell forward/futures to hedge exposure to falling prices:

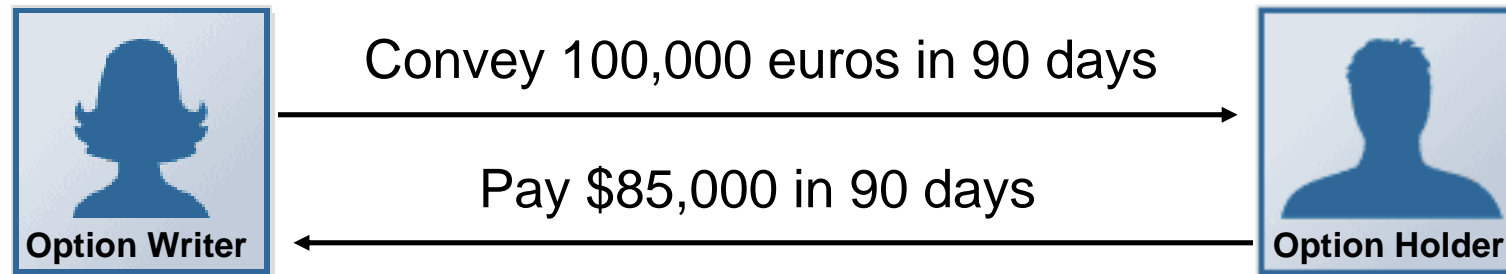
- ✦ Lock in profit margin on commodity inventory
- ✦ Lock in profit margin on future commodity sales/production with fixed cost structure
- ✦ Foreign currency receivables or revenue stream - sell currency forward to lock in dollar amount to be received
- ✦ In anticipation of a debt issuance, sell a US Treasury security forward to protect against rising interest rates (falling bond prices)

Uses of Forwards and Futures

Buy forward/futures to hedge exposure to rising prices:

- ✦ Raw materials used in manufacturing - lock in purchase price to protect margins
- ✦ Foreign currency payables or forecasted cash outflows - buy currency forward to lock in dollar amount paid
- ✦ Institutional investor that anticipates buying a bond or other debt instrument – buy US Treasury security forward as a hedge against falling interest rates (rising bond prices)

Forwards & Futures Illustration



Euros at the forward rate in 90 days.....	\$ 85,000
Assumed spot rate in 90 days.....	<u>90,000</u>
Gain in value of forward.....	\$ 5,000

Advantages Of Futures Over Fowards To Control Risk

- ✦ **Futures are easier to sell short**
- ✦ **Have lower transactions costs**
- ✦ **Have lower margin requirements which provide greater leverage opportunities**
- ✦ **Make longer durations achievable**
 - Most bonds have maturities less than 30 years at issuance; thus, achieving long durations is difficult with bonds alone.

Swap Contracts

- ✦ An agreement by two parties to exchange a series of cash flows in the future
- ✦ Typically interest rates or currencies, but may also involve commodities or equities as well.
- ✦ Very Customizable

Interest Rate Swaps

Important Notes

- ✦ Easily, the most important and most prevalent derivative product is the plain-vanilla interest rate swap
- ✦ Entering into swap exposes you to credit risk

Types of Swaps

- ✦ Plain Vanilla
- ✦ Flavored
 - *Amortizing* – decreasing notional amounts
 - *Accreting* – increasing notional amounts
 - *Seasonal* – seasonally changing notional amounts
 - *Roller coaster* – wildly fluctuating notional amounts
 - *Off-market* – pay rates not at current market rates

Currency Swaps

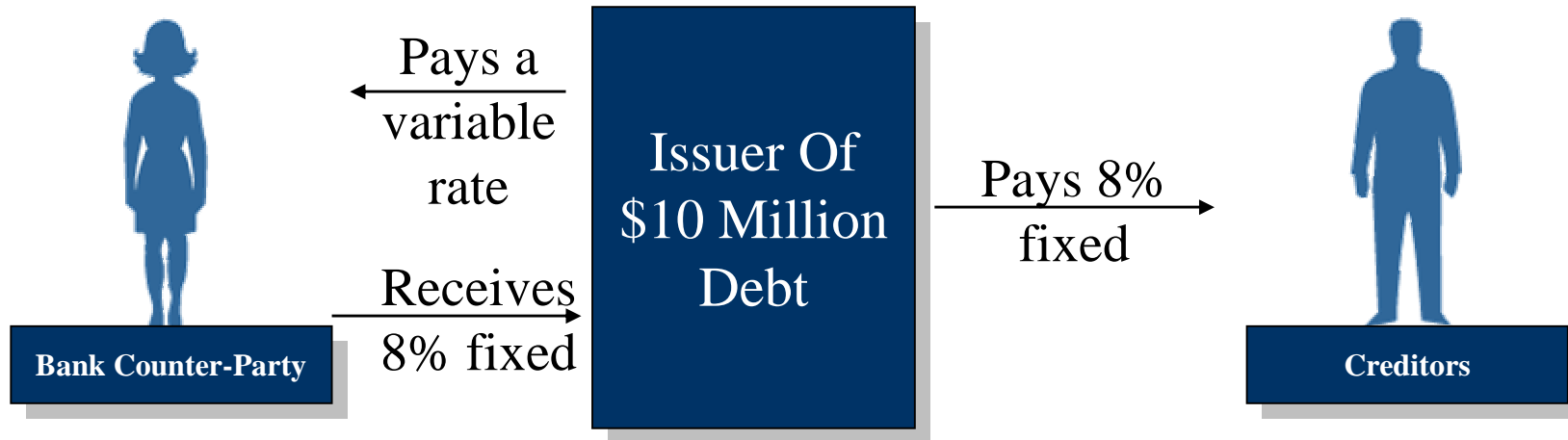
Plain Vanilla Currency Swap

- ✦ Floating rate cash flows (usually based on LIBOR) in dollars, while the other cash flows (in another currency) are based on fixed rate.

- ✦ Entered to gain access to loanable funds in a foreign currency that might be too costly to obtain from a foreign bank.

- ✦ Differs from interest rate swaps
 - Counterparties exchange notionals on effective date and return them at maturity date.
 - Periodic interest payments are not settled on net basis.

Swap Contract Diagram



If variable rate is 7.5%, Debtor:

Pays to creditors.....	\$ (800,000)
Pays to bank counterparty.....	(750,000)
Receives from bank counterparty.....	<u>800,000</u>
Net interest expense.....	\$ 750,000

Swaptions

The right, but not obligation, to enter into an interest rate swap having a predetermined fixed rate at some later date.

1. Payer Swaption or put swaption.

- ✦ Gives the buyer the right to be the fixed-rate payer (and floating-rate receiver) in a prespecified swap at a prespecified date.
- ✦ Buyer will exercise option if interest rates rise and pay the lower rate specified in the swap.

2. Receiver Swaption or call swaption.

- ✦ Gives the buyer the right to be the fixed-rate receiver (and floating-rate payer) in a prespecified swap at a prespecified date.
- ✦ Buyer will exercise option if interest rates fall and receive the higher rate specified in the swap.

2

Commodity Pricing & Embedded Derivatives

Commodity Valuation

Commodity Pricing Characteristics

Major Risks of Commodity Pricing

Embedded Derivatives

Commodity Pricing Characteristics

- ✦ Price information is location and grade specific
- ✦ Forward curve impacted by seasonality
- ✦ Contracts trade in various units of measure (Bushels, MWhs, Btu, etc)
- ✦ Contracts trade in various frequencies (Hourly, monthly, etc.)
- ✦ Settle financially or physically
- ✦ Some commodities lack ability to store
- ✦ Contracts may be based on average price over a set time period

Commodity Pricing Characteristics, cont.

- ✦ Basis swaps market
- ✦ Specialized pricing source is often needed that is not readily available (e.g. Platts)
- ✦ Less liquidity or gaps in liquidity for some longer dated forward curves
- ✦ Pricing underlying instruments to contracts can be challenging due to illiquid markets

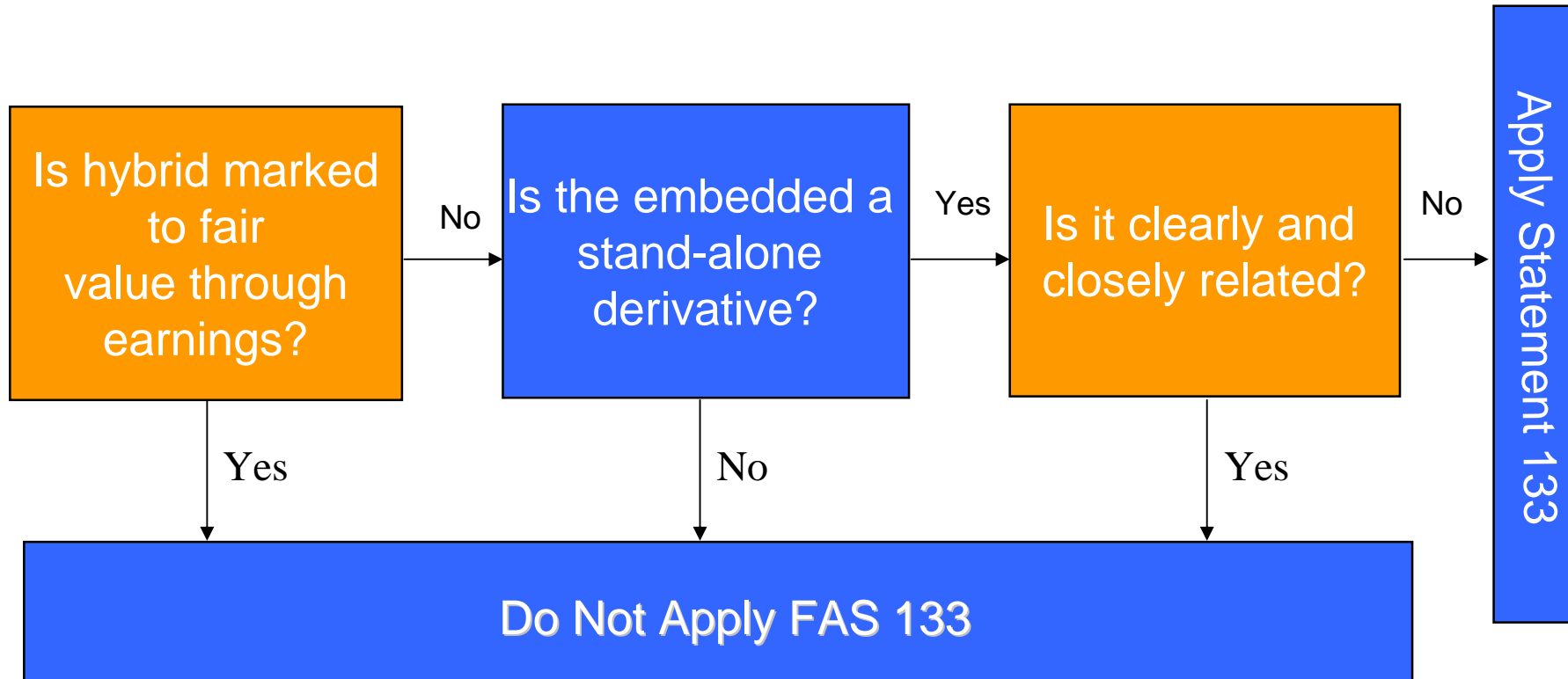
Major Risks of Commodity Pricing

- ✦ Volatility
 - ✦ The extent to which the returns of the underlying asset with fluctuate between now and maturity. It is measured by calculating the standard deviation of change in price over a given time period.
- ✦ Basis
 - ✦ Risk that the value of the derivative contract does not move in line with that of the underlying exposure
- ✦ Liquidity
 - ✦ Risk that a given asset cannot be traded quickly enough in the market to prevent a loss (or make the required profit)

Embedded Derivatives - Definition

- ✦ A derivative within another contract (Host Contract) that is not a derivative
- ✦ In certain circumstances, FAS 133 requires embedded derivatives to be bifurcated (separated) from the host contract and accounted for separately
 - ✦ Embedded features in a host contract will not have to be bifurcated and accounted for separately from the host if they are “clearly & closely related” to the host
- ✦ If the entire hybrid instrument is carried at fair value with changes in fair value included in earnings, FAS 133 does not require separate accounting for the embedded derivative

Embedded Derivative Decision Tree



Example of Embedded Derivatives

Characteristics of potential embedded derivatives that are often overlooked:

- ✦ Renewal, extension, cancellation, and prepayment options in debt arrangements (e.g. option to put debt with no premium paid or additional rate charged)
- ✦ Contracts that can be settled through multiple means (e.g., physical, stock or cash)
- ✦ Transactions and contracts (e.g., forward purchase and sale contracts) denominated in or referenced to a foreign currency that is not characteristic of either party to the transaction
- ✦ Investments in convertible, exchangeable, or indexed debt
- ✦ “If...then” provisions within contracts (e.g., a payment provision within a contract that requires additional payment if a particular index, such as an interest rate, equity, foreign currency index, moves above a predetermined cap or floor)

Keys to Valuing Embedded Derivatives

- ✦ Identifying the specific embedded feature in the host contract
- ✦ Communication with business units who executed the contract
- ✦ Build or implement a model to effectively measure the embedded feature
- ✦ Obtain reliable pricing for the underlying instruments and contract variable related to the embedded feature

3**Pricing Sources & Tools**

Pricing Sources & Tools

Commodity Pricing Sources

Commodity Market Data Sources

Commodity Market Data Providers

Commodity Valuation Tools

Market Data Utilized for Pricing

- ✦ Exchange Traded Instruments are priced directly the from the exchange (NYMEX, ICE, etc.)
- ✦ OTC
 - ✦ Libor, Treasury and other sovereign indexed instruments have widely accepted and available sources for forward curves and prices
 - ✦ Less liquid or understood indexed deals require more creative solutions
 - ✦ Consensus data providers and brokers publish prices for common OTC products

Alternative Market Sources

- ✦ Commodity forwards for modeling future cash flows derived from proprietary source
- ✦ Price derived indirectly from a correlation to a liquid market
- ✦ Use of a proxy for the market being modeled (not generally acceptable)

Keys to Alternative Pricing

- ✦ Source validated regularly
- ✦ Independent pricing obtained from deal being modeled
- ✦ Result from pricing must be observable with respect to actual contract results
- ✦ As price and value information departs from observable market the quality of the model results drops

Commodity Market Data Sources

Agriculture	Energy	Electricity	Metals
BMF (Brazil)	ICE	Brokers	BMF
ASX (Australia)	MCX (India)	ICE	Comdaq
CME	NYMEX	NYMEX	COMEX
CBOT	Platts	Regional Power Pools	Engelhard Bullion
ICE			Johnson Matthey
Kansas City Board of Trade			LME
London International Financial Futures Exchange			London Bullion Market Association
Minneapolis Grain Exchange			LPPM
US Dairy Association			MCX
Winnipeg Commodity Exchange			NYMEX

Commodity Market Data Providers

Agriculture	Energy	Electricity	Metals
Agricultural Marketing Services	Bloomberg	Bloomberg	Bloomberg
Bloomberg	Brokers	Brokers	Brokers
Brokers	Inside FERC	Megawatt Daily	Markit
Markit	Gas Daily	Regional Power Pools	Platts
Reuters	Gas Market Report	Reuters	Reuters
	Natural Gas Week	Totem (Markit)	
	Natural Gas Intelligence		
	OPIS		
	Platts		
	Reuters		
	Totem (Markit)		

Commodity Valuation Tools

- ✧ Modeling Tools
 - ✧ FEA
 - ✧ FinCad
 - ✧ Numerix
 - ✧ SavvySoft
 - ✧ Excel based analytic add-ins
- ✧ Third Party Applications
 - ✧ Fincad (The Perfect Hedge)
 - ✧ FXPress (First)
 - ✧ OpenLink (Endur)
 - ✧ Reval (HedgeRx)
 - ✧ Sungard (Aligne, Entegrated)
 - ✧ TriplePoint (Commodity XL)

Additional Reference Sources

- ✦ Platts (www.platts.com)
- ✦ ICE (www.theice.com)
- ✦ Markit (www.markit.com)
- ✦ NYMEX (www.nymex.com)
- ✦ CME (www.cmegroup.com)
- ✦ LME (www.lme.com)
- ✦ NERC (www.nerc.com) (North American Electric Reliability Corp)
- ✦ Energy Commentary (Natural Gas Week) (www.energyintel.com)
- ✦ BMF (www.bmf.com.br)
- ✦ Oil (OPIS) (www.opisnet.com)
- ✦ Johnson Matthey (www.matthey.com)

Questions

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3**Appendix**

Modeling Challenges

Consistency

Indirectly Derived Information

Passes Validation

Lower Model Risks

Consistency

- ✦ Approach
 - ✦ For each type of embedded instrument in an organization it is important to have a consistent model (risk for variability in approach is control breakdowns)
- ✦ Set Up
 - ✦ A result consistent with variable inputs and observable events requires surprising amount of rigor on model set up
- ✦ Discounting
 - ✦ Discounting for all cash flows should be consistently applied (at least same curves for similar instruments)

Indirectly Derived Info

- ✦ Forecast of Non-Standard
 - ✦ Forecasts are the basis for the cash flows used for valuing so back testing and evaluation of numerous scenarios is needed to develop non standard estimates that are reliable
- ✦ Basket calculations
 - ✦ When baskets are part of the calculations the correlations need to be tightly monitored for all the components as well as any simulation related parameters

Validation

- ✦ Embedded features are typically not always market traded so every effort needs to be made to apply market conventions as used “local” to the deals
 - ✦ Discounting
 - ✦ Credit
- ✦ Documentation
 - ✦ Detailed documentation on inputs, calculations, and assumptions kept with model
 - ✦ Controls related to the model including hedge accounting referenced in model

Work to Lower Model Risks

- ✦ Pricing inconsistency
 - ✦ Establish relationships with pricing services and ensure regular review and research of alternatives
- ✦ Calculation material difference
 - ✦ Conduct regular internal and external validation of model mechanics, inputs, and reporting needs
- ✦ Model not calibrated and creating bad forecasts
 - ✦ Conduct regular back testing and re-calibration exercises